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FUEL CELL : Mail Stop: AMENDMENT

TRANSLATOR'S DECLARATION

I, Itsuro Makino, declare:

That I am thoroughly familiar with the Japanese and English languages;

That I am competent to serve as a translator of Japanese documents into English;

That the attached document represents a true English translation of Japanese application 2003-014090, filed January 22, 2003 and that

I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Signed this 3rd day of January, 2011

J. Makino

Itsuro MAKINO

[Name of Document] SPECIFICATION

[Title of the Invention] FUEL CELL

[CLAIMS]

[Claim 1]

5 A fuel cell which comprises a cathode and an anode arranged to sandwich a proton-conductive ion exchange electrolytic membrane, oxygen and hydrogen containing carbon monoxide being supplied to the cathode and the anode, respectively, in which the cathode comprises an electroconductive porous substrate which carries thereon platinum and a proton-conductive ion exchange electrolytic polymer, and the anode comprises an electroconductive porous substrate which carries thereon platinum or a platinum alloy and a proton-conductive ion exchange electrolytic polymer, and further at least the anode carries a proton-supplying material thereon.

10 10

15 [Claim 2]

The fuel cell according to claim 1, wherein the proton-supplying material is at least one selected from the group consisting of:

- (a) a proton acid,
- 20 (b) a salt of a proton acid and a basic compound, and
- (c) an electroconductive polymer composition doped with a proton acid.

[Claim 3]

The fuel cell according to claim 2, wherein the proton acid is 25 a mineral acid or a polymeric acid.

[Claim 4]

The fuel cell according to claim 2, wherein the basic compound which forms a salt with the proton acid is a polymer having a basic group in the molecule.

30 [Detailed Description of the Invention]

[0001]

[Industrial Availability]

The present invention relates to a solid polymer fuel cell, in particular, a solid polymer fuel cell which has an anode on which 35 platinum or a platinum alloy is carried as an electrode catalyst, and

which produces a high power by restraining the electrode catalyst from being poisoned with carbon monoxide even if reformed hydrogen containing carbon monoxide is used as a fuel supplied to this anode.

5 [0002]

[Prior Art]

In recent years, there have been developed fuel cells in which: an anode and a cathode on which platinum is carried are arranged to sandwich a solid polymer electrolytic membrane to form 10 an electrode/solid electrolytic membrane/electrode structure; the electrode/solid electrolytic membrane/electrode structure is sandwiched between a pair of current collectors each having a channel formed in the inside face thereof; and a fuel and oxygen are supplied into the two channels, respectively, thereby generating 15 electricity. There has also been made research on lamination or two-dimensional connection of such fuel cells to improve the voltage or power thereof, thereby the resultant is integrated into a system.
[0003]

From the viewpoint of a feature that such fuel cells are clean 20 and have high efficiency, and are not required to be electrically charged for a long period as performed in conventional secondary cells, but they can be substantially continuously used so long as fuel is continuously supplied thereto, attention is paid to the use thereof for various purposes, in particular, power sources for electric 25 automobiles, individual power sources for household, power sources for portable instruments, and others.
[0004]

Meanwhile, as a fuel supplied to the anode, the following has 30 been typically studied: a gas fuel such as pure hydrogen, or hydrogen generated from a fuel such as alcohol or hydrocarbon by use of a reforming catalyst, which may be referred to as reformed hydrogen hereinafter; a mixed liquid fuel, such as water and methanol, dimethyl ether, ethylene glycol or polyhydric alcohol; or the like. However, problems remain. That is, fuel cells using 35 liquid fuel produce a low power and fuel cells using gas fuel output

a low volume energy density from the viewpoint of storage and transportation thereof.

[0005]

Thus, there is suggested a method of mounting not only a fuel cell itself but also a reforming device onto a system, thereby generating electricity while at the same time generating reformed hydrogen from a liquid fuel. However, carbon monoxide is generated in the reforming-reaction and it remains in the reformed hydrogen so as to cause a problem that the carbon monoxide poisons the platinum catalyst to make the power of the fuel cell low. To cope with the problem, there is known a measure in which a device for removing carbon monoxide is appended to the reforming device. However, according to such a measure, the whole of the system becomes large-sized, causing a problem against use for portable instruments or automobiles, in which a usable space is limited. Thus, in the present circumstances, the content of carbon monoxide cannot be decreased to a level such that the carbon monoxide has no effect of poisoning. Thus, as another method, various platinum alloy catalysts, a typical example of which is an alloy of platinum and ruthenium, are proposed as electrode catalysts which are less poisoned than platinum. However, advantageous effects thereof have not yet been sufficiently obtained.

[0006]

[Problems to be Solved by the Invention]

The present invention has been made in order to solve the above-mentioned problems involved in such a polymer fuel cell which has an anode on which platinum or a platinum alloy is carried as an electrode catalyst wherein reformed hydrogen is supplied as fuel into the anode. Therefore, it is an object of the invention to provide a solid polymer fuel cell making it possible to restrain the electrode catalyst from being poisoned with carbon monoxide contained in reformed hydrogen, thereby to produce a high power.

[0007]

[Means to Solve the Problems]

The invention provides a fuel cell which comprises a cathode and an anode arranged to sandwich a proton-conductive ion exchange electrolytic membrane, oxygen and hydrogen containing carbon monoxide being supplied to the cathode and the anode,

5 respectively, in which the cathode comprises an electroconductive porous substrate which carries thereon platinum and a proton-conductive ion exchange electrolytic polymer, and the anode comprises an electroconductive porous substrate which carries thereon platinum or a platinum alloy and a proton-conductive ion

10 exchange electrolytic polymer, and further at least the anode carries a proton-supplying material thereon.

[0008]

[Embodiments of the Invention]

The fuel cell of the invention comprises a cathode and an

15 anode arranged to sandwich a proton-conductive ion exchange electrolytic membrane, in which the cathode comprises an electroconductive porous substrate which carries thereon platinum and a proton-conductive ion exchange electrolytic polymer, and the anode comprises an electroconductive porous substrate which

20 carries thereon platinum or a platinum alloy and a proton-conductive ion exchange electrolytic polymer, and further at least the anode carries a proton-supplying material thereon.

[0009]

The cathode and the anode each comprise an

25 electroconductive porous substrate on which an electrode catalyst layer is formed. The electrode catalyst layer comprises, for example, carbon black powder on which fine particles of the above-mentioned noble metal are carried, carbon black powder as an electroconductive auxiliary, a binder for bonding these to each other,

30 and a proton-conductive ion exchange electrolytic polymer which is a conductor of protons generated by electrochemical reaction.

[0010]

According to the invention, in particular, the cathode comprises an electroconductive porous substrate which carries

35 thereon platinum and a proton-conductive ion exchange electrolytic

polymer, and the anode comprises an electroconductive porous substrate which carries thereon platinum or a platinum alloy (for example, platinum-ruthenium alloy) and a proton-conductive ion exchange electrolytic polymer, with at least the anode carrying
5 thereon a proton-supplying material.

[0011]

Accordingly, the cathode is produced, for example, as follows. Electroconductive carbon black powder on which fine particles of platinum are carried and carbon black as an electroconductive
10 auxiliary are made into paste by use of an appropriate binder (for example, a solution of polyvinylidene fluoride resin in N-methyl-2-pyrrolidone or a perfluorosulfonic acid resin solution such as Nafion® manufactured by Du Pont Co.), and the paste is applied onto an electroconductive porous substrate (for example,
15 carbon paper manufactured by Toray Industries, Inc.), and the product is heated and dried. The product is further coated with a solution of a proton-conductive ion exchange electrolytic polymer (for example, Nafion® manufactured by Du Pont Co.), heated and dried, thereby providing the cathode. However, the process for
20 producing the cathode is not particularly limited in the invention.
[0012]

Similarly, the anode is produced as follows. Electroconductive carbon black powder on which fine particles of platinum or a platinum alloy are carried and carbon black as an electroconductive auxiliary are made into paste by use of an appropriate binder as described above, and the paste is applied onto an electroconductive porous substrate as described above, and the product is heated and dried. The product is then impregnated with, for
25 example, a solution of a proton-supplying material, heated and dried. Thereafter, the product is further coated with a solution of a proton-conductive ion exchange electrolytic polymer as described above, heated and dried, thereby providing the anode. However,
30 the process for producing the anode is not particularly limited as long as the anode has a proton-supplying material.

35 [0013]

In the invention, the proton-supplying material is at least one selected from the group consisting of:

- (a) a proton acid,
- (b) a salt of a proton acid and a basic compound, and
- 5 (c) an electroconductive polymer composition doped with a proton acid.

[0014]

Herein, the proton acid may be a mineral acid or an organic acid. In short, the acid may be any acid from which a proton can 10 be dissociated and released. Examples of the mineral acid include sulfuric acid, hydrochloric acid, phosphoric acid, perchloric acid, bromic acid, nitric acid, boric acid, iodic acid, hydrofluoric acid, phosphohydrofluoric acid, and borohydrofluoric acid. However, the mineral acid is not limited thereto.

15 [0015]

Meanwhile, the organic acid is an aliphatic, aromatic, aromatic aliphatic or alicyclic organic carboxylic acid, and may be a monobasic acid or a polybasic acid. Furthermore, the organic acid 20 may have a substituent such as a hydroxyl group, a halogen, a nitro group, a cyano group, an amino group, and so on. Accordingly, specific examples of the organic acid include acetic acid, lactic acid, pentadecafluoroctanic acid, pentafluoroacetic acid, trifluoroacetic acid, trichloroacetic acid, dichloroacetic acid, monofluoroacetic acid, monobromoacetic acid, monochloroacetic acid, cyanoacetic acid, 25 acetylacetic acid, nitroacetic acid, triphenylacetic acid, formic acid, oxalic acid, benzoic acid, m-bromobenzoic acid, p-chlorobenzoic acid, m-chlorobenzoic acid, o-nitrobenzoic acid, 2,4-dinitrobenzoic acid, 3,5-dinitrobenzoic acid, picric acid, o-chlorobenzoic acid, p-nitrobenzoic acid, m-nitrobenzoic acid, trimethylbenzoic acid, 30 p-cyanobenzoic acid, m-cyanobenzoic acid, Thymol Blue, 5-aminosalicylic acid, o-methoxybenzoic acid, 1,6-dinitro-4-chlorophenol, 2,6-dinitrophenol, 2,4-dinitrophenol, p-oxybenzoic acid, Bromophenol Blue, mandelic acid, phthalic acid, isophthalic acid, maleic acid, fumaric acid, malonic acid, tartaric acid, citric acid, lactic acid, succinic acid, α -alanine, β -alanine, glycine, glycolic 35 acid.

acid, thioglycolic acid, ethylenediamine-N,N'-diacetic acid, and ethylenediamine-N,N,N',N'-tetraacetic acid.

[0016]

The organic acid may be such that it has a sulfonic acid group or a sulfuric acid group. Specific examples of such an organic acid include aminonaphtolsulfonic acid, metanilic acid, sulfanyl acid, allylsulfonic acid, laurylsulfuric acid, xylenesulfonic acid, chlorobenzenesulfonic acid, 1-propanesulfonic acid, 1-butanesulfonic acid, 1-hexanesulfonic acid, 1-heptanesulfonic acid, 10 1-nonanesulfonic acid, 1-decanesulfonic acid, 1-dodecanesulfonic acid, benzenesulfonic acid, styrenesulfonic acid, p-toluenesulfonic acid, and naphthalenesulfonic acid.

[0017]

Further in the invention, the organic acid may be a polymer, or a polymer acid, which has in the molecule a carboxyl group, a sulfonic acid group, or a sulfuric acid group, among which is preferred a polymer acid having a sulfonic acid group or a sulfuric acid group. Specific examples of such a polymer acid include polyvinylsulfonic acid, polyvinylsulfuric acid, polystyrenesulfonic acid, sulfonated styrene/butadiene copolymer, polyallylsulfonic acid, polymethallylsulfonic acid, poly-2-acrylamide-2-methylpropane-sulfonic acid, polyacrylic halide, and phenolsulfonic acid novolac resin.

[0018]

According to the invention, the proton-supplying material may be a salt of a proton acid as described above and a basic compound. However, such a basic compound that has a negative charge such as a hydroxyl ion or an alkoxyl ion is not preferred since the compound is neutralized with the proton acid so that 25 protons vanish. According to the invention, the basic compound is preferably a compound which has not any electric charge but has a free electron pair to exhibit basicity. Accordingly, such a basic compound is preferably an organic amine or a nitrogen-containing heterocyclic compound. Specifically, examples thereof include 30 aliphatic or alicyclic amine compounds such as triethylamine, 35

ethylenediamine and piperidine; aromatic amines such as aniline, diphenylamine, phenylenediamine and toluidine; and nitrogen-containing aromatic heterocyclic compounds such as pyridine and imidazole.

5 [0019]

The basic compound which forms a salt with the proton acid to form a salt may be a polymer. Such a polymer is preferably a polymer having in the molecule thereof a basic group such as an amino group, that is, a polymeric base. Accordingly, the main 10 polymer chain of such a polymeric base may be a polyolefin, a polyamide, a polyimide, a polyether, a condensed heterocyclic polymer or the like, and is not particularly limited.

[0020]

Specific examples of the polymeric base in the present 15 invention include polyvinylamine, polyallylamine, polyvinylpyridine, polyvinylimidazole, polybenzimidazole, and polyquinoline. Besides, a polymeric base wherein an aromatic ring has a basic group such as an amino group can easily be obtained by nitrating a polymer having in the molecule an aromatic ring with a nitrating agent such 20 as mixed acid in accordance with an ordinary method, and then reducing the nitro group thus introduced into the polymer to an amino group by various methods that have been conventionally known.

[0021]

25 Further according to the invention, the proton-supplying material may be an electroconductive polymer doped with a proton acid. As an example of a polymer capable of releasing a proton acid, there is mentioned an electroconductive polymer obtained by converting a p-type electroconductive polymer to an oxidized form 30 and doping the oxidized form polymer with a proton acid. Specific examples of such an electroconductive polymer include polyaniline, polyalkylaniline, poly(o-phenylenediamine), polypyrrole, and polyindole. As to an n-type electroconductive polymer, it is reduced electrolytically in the presence of a proton acid and the resulting 35 electroconductive polymer doped with a proton acid can be used as a

proton-supplying material. Specific examples of such an n-type electroconductive polymer include polyphenylquinoxaline.

[0022]

According to the invention, it is particularly preferred that
5 the proton-supplying material contains a polymer in order to restrain the proton-supplying material from being lost from the electrode even if the fuel cell is used over a long term. For example, it is desired to use a polymeric acid or an electroconductive polymer composition as the proton acid, or it is
10 desired to use a salt of a proton acid and a polymeric base as the proton-supplying material.

[0023]

According to the invention, such a proton-supplying material is carried on at least the anode. The amount of the
15 proton-supplying material carried on the anode is usually from 10 to 10000 parts by weight per 100 parts by weight of the amount of platinum or the platinum alloy carried on carbon paper. When the amount of the proton-supplying material carried on the anode is less than 10 parts by weight per 100 parts by weight of the amount of
20 platinum or the platinum alloy carried on the carbon paper, the effect of restraining the anode from being poisoned with carbon monoxide is insufficient. On the other hand, when the amount is more than 10000 parts by weight, there are unfavorably generated inconveniences such as corrosion of metal regions of the system for
25 the fuel cell, such as pipes or cells thereof.

[0024]

In the fuel cell of the present invention, a cation exchange membrane made of a perfluorosulfonic acid resin, for example, Nafion®, as used in conventional solid polymer membrane type cells,
30 is preferably used as a proton conductive ion exchange electrolytic membrane. However, the proton conductive ion exchange electrolytic membrane used is not limited to the above. Thus, for example, the following can be used: a porous membrane made of a fluorocarbon resin, such as polytetrafluoroethylene, impregnated
35 with the above-mentioned Nafion® or some other ion conductive

material; or a porous membrane or nonwoven fabric made of a polyolefin resin such as polyethylene and polypropylene carrying thereon the above-mentioned Nafion® or some other ion conductive material. In the invention, however, the proton conductive ion exchange electrolytic membrane is not regarded as a member falling under the category of the proton-supplying material.

[0025]

In the fuel cell according to the invention, gaseous oxygen is supplied into the cathode, and gaseous hydrogen containing carbon monoxide is supplied into the anode. The oxygen may be air. As the hydrogen containing carbon monoxide, for example, reformed hydrogen, which is generated from a fuel such as an alcohol or hydrocarbon by use of a reforming catalyst, is preferably used. In particular, in the fuel cell according to the invention, it is possible to effectively restrain the anode from being poisoned with the electrode catalyst thereby to output a high power over a long term even if reformed hydrogen containing 10 to 5000 ppm of carbon monoxide is used as the fuel therefor.

[0026]

The process for producing reformed hydrogen is already well-known. For example, for the purpose of reforming methanol, a reforming catalyst is used to subject methanol to steam reforming and further carbon monoxide reforming, thereby hydrogen and carbon dioxide can be obtained. The reformed hydrogen obtained by such methanol reforming still contains a large amount of carbon monoxide; therefore, carbon monoxide is catalytically oxidized selectively into carbon dioxide, thereby to reduce the amount of carbon monoxide in the reformed hydrogen to several hundreds of parts per million. However, the origin of the hydrogen containing carbon monoxide used as the fuel in the invention is not particularly limited.

[0027]

The operating temperature of the fuel cell of the invention is usually 0°C or higher, preferably from 15 to 120°C, and in particular preferably from 30 to 100°C. When the operating

temperature is too high, deterioration and exfoliation of the used materials, or others may be caused.

[0028]

[Examples]

5 The present invention will be described by way of the following examples. However, the invention is not limited by these examples.

[0029]

Example 1

10 180 mg of electroconductive carbon black powder (EC-20-PTC, manufactured by ElectroChem, Inc., USA) on which platinum was carried in an amount of 20% by weight, 36 mg of electroconductive carbon black, 24 mg of polyvinylidene fluoride, and 940 mg of N-methyl-2-pyrrolidone were mixed in a mortar to prepare a paste.

15 A portion of the paste was applied onto one surface of a carbon paper 2.3 cm square (TGP-H-90, manufactured by Toray Industries, Inc., and having a thickness of 260 µm), and heated at 80°C for 60 minutes and dried. The amount of the solid contents carried on the thus prepared platinum-carrying carbon paper was 20 mg. The

20 amount of the platinum in the solid contents was 3 mg. Then, a 5% by weight alcohol solution (manufactured by Aldrich Co.) of a proton conductive ion exchange electrolytic polymer, Nafion®, was applied onto the platinum-carrying surface of the platinum-carrying carbon paper, and heated at 80°C for 30 minutes and dried, thereby

25 yielding a cathode.

[0030]

The same platinum-carried carbon paper as described above was prepared. Then, a solution of undoped polyphenylquinoxaline in m-cresol was dropped onto the platinum-carrying surface of the 30 platinum-carrying carbon paper, and heated at 80°C for 120 minutes and dried. The amount of the polyphenylquinoxaline carried on the thus prepared platinum-carrying carbon paper was 1 mg. In this way, polyphenylquinoxaline was carried on the platinum-carrying surface of the platinum-carrying carbon paper, and further a 5% by 35 weight alcohol solution (manufactured by Aldrich Co.) of the

Nafion® was applied onto the surface, and heated to 80°C for 30 minutes and dried. The thus obtained electrode was fixed onto a platinum wire, and then electrolytically reduced at -0.2 V (vs. SCE) in a 6 M solution of sulfuric acid in water for 30 minutes to n-type 5 dope the polyphenylquinoxaline, thereby sulfuric acid was carried thereon, and then heated 80°C and dried in the atmosphere of nitrogen for 60 minutes, thereby an anode was yielded.

[0031]

An acid-type Nafion® membrane (Nafion® 112, manufactured 10 by Du Pont Co.) was put as a proton conductive ion exchange electrolytic membrane between the thus obtained cathode and anode, and then the resultant was heated and pressed using a hot press in the atmosphere of nitrogen at a temperature of 135°C, thereby providing an electrode-proton exchange membrane assembly. Using 15 the assembly, a mono-layered fuel cell for tests was fabricated.

[0032]

The fuel cell was integrated into a fuel cell evaluating device (manufactured by Toyo Corp., the same hereinafter), and the 20 temperature of the cell was set to 70°C. At a humidifier temperature of 70°C, oxygen gas was supplied into the cathode at a rate of 500 mL/minute, and simultaneously at a humidifier temperature of 70°C, a hydrogen/carbon dioxide mixed gas (containing 200 ppm of carbon monoxide, and having a molar ratio 25 of hydrogen/carbon dioxide of 75/25) was supplied into the anode at a rate of 500 mL/minute. The pressure for supplying the gases was set to normal pressure. The power density of the cell as calculated based on current-voltage characteristics (I-V characteristics) measured under the conditions as mentioned above was 33 mW/cm² at a voltage of 0.4 V.

30 [0033]

Example 2

120 mg of electroconductive carbon black powder (EC/20/10-PT/RU, manufactured by ElectroChem, Inc., USA) on which a platinum-ruthenium alloy (having a weight ratio of 35 platinum/ruthenium of 2/1) was carried in an amount of 30% by

weight, 96 mg of electroconductive carbon black, 24 mg of polyvinylidene fluoride, and 940 mg of N-methyl-2-pyrrolidone were pulverized and mixed in a mortar to prepare a paste. A portion of the paste was applied onto one surface of the same carbon paper 2.3 cm square as in Example 1, and heated at 80°C for 60 minutes and dried. The amount of the solid contents carried on the thus prepared platinum-ruthenium alloy carrying carbon paper was 20 mg. The amount of the platinum-ruthenium alloy in the solid contents was 3 mg. Then, a 5% by weight alcohol solution 5 (manufactured by Aldrich Co.) of a proton conductive ion exchange electrolytic polymer, Nafion®, was applied onto the platinum-ruthenium alloy carrying surface of the platinum-ruthenium alloy carrying carbon paper, and heated at 80°C for 30 minutes and dried. Thereafter, the resultant was immersed into a 4 M solution of 10 sulfuric acid in water at room temperature for 30 minutes, and then heated at 80°C for 60 minutes and dried, thereby yielding an anode. 15 [0034]

An acid-type Nafion® membrane (Nafion® 112, manufactured by Du Pont Co.) was put between the thus obtained anode and a 20 cathode obtained in the same way as in Example 1, and then heated and pressed using a hot press at a temperature of 135°C, thereby providing an electrode-proton exchange membrane assembly. Using the assembly, a mono-layered fuel cell for tests was fabricated 25 [0035]

The fuel cell was integrated into a fuel cell evaluating device, and the temperature of the cell was set to 40°C. At a humidifier 30 temperature of 40°C, oxygen gas was supplied into the cathode at a rate of 500 mL/minute, and simultaneously at a humidifier temperature of 40°C, a hydrogen/carbon dioxide mixed gas (containing 200 ppm of carbon monoxide, and having a molar ratio of hydrogen/carbon dioxide of 75/25) was supplied into the anode at a rate of 500 mL/minute. The pressure for supplying the gases was set to normal pressure. The power density of the cell as calculated based on current-voltage characteristics (I-V characteristics) 35 measured under the conditions as mentioned above was 36 mW/cm²

at a voltage of 0.4 V.

[0036]

Comparative Example 1

A mono-layered fuel cell for tests was fabricated in the same manner as in Example 1 except that when the anode was prepared, no polyphenylquinoxaline was carried thereon and the electrolytic reduction for n-type doping in the 6 M solution of sulfuric acid in water was not performed. Current-voltage characteristics (I-V characteristics) were measured under the same conditions as Example 1. As a result, the power density of the cell was 9 mW/cm² at a voltage of 0.4 V.

[0037]

Comparative Example 2

A mono-layered fuel cell for tests was fabricated in the same way as in Example 1, using an anode yielded in the same manner as in Example 2 except that when the anode was produced, no sulfuric acid was carried on the anode. Current-voltage characteristics (I-V characteristics) were measured under the same conditions as Example 2. As a result, the power density of the cell was 12 mW/cm² at a voltage of 0.4 V.

[0038]

[Effects of the Invention]

As described above, according to the invention, at least the anode carries the proton-supplying material. As a consequence, even if hydrogen containing carbon monoxide is supplied as fuel to the anode which comprises platinum or platinum-ruthenium alloy as an electrode catalyst, the electrode catalyst of the anode is restrained from being poisoned with carbon monoxide, thereby obtaining a fuel cell producing a high power.

[Name of Document] ABSTRACT

[Abstract]

[Problems to be Solved]

The object of the invention is to provide a solid polymer fuel
5 cell which comprises an anode which carries thereon platinum or
platinum alloy as an electrode catalyst carried and which still
makes it possible to restrain the electrode catalyst from being
poisoned with carbon monoxide thereby producing a high power even
if reformed hydrogen containing carbon monoxide is supplied as fuel
10 to the anode.

[Means to Solve the Problems]

The invention provides a fuel cell which comprises a cathode
and an anode arranged to sandwich a proton-conductive ion
exchange electrolytic membrane, oxygen and hydrogen containing
15 carbon monoxide being supplied to the cathode and the anode,
respectively, in which the cathode comprises an electroconductive
porous substrate which carries thereon platinum and a
proton-conductive ion exchange electrolytic polymer, and the anode
comprises an electroconductive porous substrate which carries
20 thereon platinum or a platinum alloy and a proton-conductive ion
exchange electrolytic polymer, and further at least the anode carries
a proton-supplying material thereon.

[Selected Drawings]

None